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**Final Report of a Phase II Non-Point Source
Pollution Implementation Project for
Lake Luxembourg/Core Creek Watershed,
Core Creek Park, Bucks County, Pennsylvania**

*Funding provided by the PA Department of
Environmental Protection through Section 319
of the Federal Clean Water Act by the
U.S. Environmental Protection Agency*

Prepared for:

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Project Nos. 121.01 through 121.11

November 2002





Figure 1

SOURCE:

USGS 7.5 Minute Topographic Series

-Langhorne, Pa 1993

SCALE:

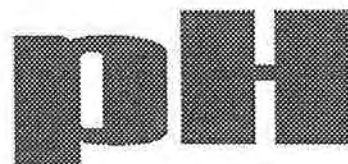
1" = 2,000'



USGS Site Topography Map

Core Creek Watershed Restoration Measure Locations
Townships of Middletown and Newtown
Bucks County, Pennsylvania

Project No. 121.05 - 121.09



1993). Such changes in land use will shift the NPS pollutants from agricultural fertilizers and animal waste, to lawn fertilizers and runoff over impervious surfaces. This shift in the types of NPS pollutants and the sources of these pollutants, have yet to be addressed in terms of the Core Creek Management Plan. Therefore, a second Phase II Implementation Project was awarded to Bucks Conservation District in 1999 in an effort to address these evolving NPS pollutant issues. This report documents the findings and results of this second Phase II Implementation Project.

4.0 Identified Scope of Work for the Second Phase II Implementation Project

As originally identified in the proposal submitted to PADEP, there were three primary objectives of the second Phase II Implementation Project for Core Creek. Each objective is outlined below. The three objectives included:

1. Begin to address the increasing contribution residential land will have on the NPS pollutant load of Core Creek,
2. Implement several shoreline buffer / streambank stabilization projects within the Core Creek watershed and
3. Continue the in-lake and watershed water quality monitoring program.

As will be provided in detail below, each of these three objective were attained with the NPS (319) funds provided to the Bucks County Conservation District from PA DEP and US EPA.

Why was the second Phase II Implementation Project needed? - Prior to the initiation of the second Phase II Implementation Project, the only sources of NPS pollutants within the Core Creek watershed formally addressed was surface runoff from agricultural land. While agricultural runoff was quantified as the largest contributor to NPS pollution within the Core Creek watershed, alterations in land use over the past 20 years have shifted more toward residential land use. The type and quantities of NPS pollutants generated from agricultural and residential land substantially differ (US EPA, 1990), so action now needs to be taken to ensure that the NPS load generated from residential land is kept at a minimum in the future. Such a strategy requires both preventative (public education) and pro-active (installation of structural BMPs) measures.

The construction of Core Creek Park was completed in 1979 and since then it has become the most widely used park in Bucks County, PA (Coastal, 1993). Since its completion, attendance at Core Creek Park is estimated to have increased by 10% each year and reached 1,273,014 in 1992 (Pfanstiel, 1993). The park offers a wide range of recreational activities including fishing, boating, picnicking, hiking, jogging and horseback riding. The park has boat ramps, a mooring beach, fishing piers, tennis courts, playgrounds, athletic fields and group camping facilities available for park visitors. Based on the rapid population growth in both Bucks County and the three Townships within the Core Creek watershed, as well as the heavy amount of recreational use that the park receives, this second Phase II NPS Implementation Project was required to preserve and enhance these important local resources.

What Best Management Practices (BMPs) were implemented? - The BMPs implemented for the second Phase II project included shoreline buffers and streambank stabilization. These BMPs included a variety of structural (rip-rap, biolog, filter fabric) and bioengineering (emergent macrophytes, wetland plants, vegetative cuttings) measures to achieve their desired goals. Institutional BMPs included the development of a highly detailed social science curriculum for the FDR Middle School, Bristol Township, Bucks County, PA, as well as a number of public presentations on the Core Creek / Lake Luxembourg system and the impacts of residential sources of NPS pollution.

A specific list of the shoreline and streambank BMPs that were implemented for the second Phase II project are listed in Section 5.0. Each BMP was designed to reduce shoreline / streambank erosion and their associated generation of TP and TSS pollutant loads. The BMPs which included the planting of vegetation (e.g. stabilization of the swale and the two shoreline stabilization projects) also address dissolved pollutants such as phosphorus and nitrogen through the assimilation of these pollutant via plant uptake. Details on the measured reductions in the incoming pollutant loads, as well as in-lake concentrations are provided in the project-end water quality report.

Section 5.0 Project Work Plan

In order to successfully complete the three main project objectives outlined in Section 4.0, a number of identified tasks had to be completed. For convenience a brief description of each task is provided below.

Task 1 - Development of a Work/Quality Assurance Project Plan

Since the second Phase II Implementation Project included both in-lake and watershed-based water quality monitoring, a Work / Quality Assurance Project Plan had to be developed. A copy of this Project Plan is provided in Appendix B and was approved by both PA DEP and US EPA.

Task 2 - Educational Measures to Control the NPS Pollutant Load

The goal of this task was to implement a number of institutional measures to educate stakeholders on the impacts of residential-based NPS pollution on Core Creek and Lake Luxembourg. Such educational measures are more preventative in approach relative to the installation of structural BMPs.

The large portion of this task was concerned with the development and implementation of a social science curriculum that focused on the Core Creek watershed, Lake Luxembourg, water quality and the use of structural BMPs to reduce NPS pollution. A copy of the curriculum is provided in Appendix C.

Representatives of Princeton Hydro met with students of the advance ecology class at FDR Middle School, Bristol Township, Bucks County, PA through the course of the 1999-2000 school year. The students of this class are taught by Ms. Kathleen Horwatt of the Bristol Township School District and are known as the "Flood Kids". The "Flood Kids" have designed and developed educational brochures on the impacts and solutions to local and regional flooding, as well as give public presentations on these subjects. Given the pro-active interests of these students, the Bucks County Conservation District and Princeton Hydro worked with the Flood Kids in the development of the curriculum and the production of an educational brochure. A copy of the educational brochure is provided in Appendix D.

Another final product associated with the educational component of the project was a full day watershed seminar and tour which was conducted on 18 February 2000. A copy of the invitation, the tour agenda, and the associated educational booklet area all provided in Appendix D.

The watershed tour was broken into two main components. In the morning, short presentations were made by various professional within the environmental, engineering and planning fields to students from both FDR Middle School and Neshaminy Middle School. Some of the presenters included representatives from PADEP, the Bucks County Conservation District, the

USDA / NRCS, the Bucks County Department of Parks and Recreation, and a private consulting firm (Princeton Hydro, LLC).

In the afternoon, the students were taken on a tour of the Core Creek watershed. Representatives from FDR Middle School, PADEP, and Princeton Hydro took the students to various sites throughout the watershed to demonstrate existing examples of various residential and agricultural BMPs. The tour was concluded at Lake Luxembourg where the students were shown the shoreline and streambank sites that were targeted for stabilization under the second Phase II Implementation Project. Information on water quality monitoring, with a particular emphasis placed on Lake Luxembourg and Core Creek, was also included as part of the tour. Details on the actual tour and the visited sites are included in Appendix D.

A public seminar was also held at FDR Middle School on 9 June 2000 (Appendix D). At this time, a number of professionals from the fields of environmental science, engineering and planning gave presentations on Core Creek and Lake Luxembourg, the impacts of stormwater and NPS pollution and the use of structural BMPs to improve water quality. Specific issues addressed during the seminar included:

1. General information on the residential sources of NPS pollution,
2. An up-to-date review of the various BMPs that can be used to reduce NPS pollution in residential areas,
3. A survey of the advantages, disadvantages and costs associated with each BMP,
4. And information on general methodology for the selection of appropriate BMPs.

Representatives of the Bucks County Conservation District attended the seminar and distributed free copies of The Pennsylvania Handbook of Best Management Practices for Developing Areas. The seminar was concluded by the FDR "Flood Kids" giving a Power Point presentation on NPS pollution and stormwater management. Approximately 75 people attended the public seminar.

Finally, another component of the public education program of the second Phase II Implementation Project was having the students of Neshaminy Middle School assist in planting vegetation along the north central shoreline of Lake Luxembourg on 25 April 2001. Student assistance with the installation of the shoreline vegetation was photo-documented (Appendix E).

Task 3 - Implementation of Five Streambank / Shoreline Restoration Projects

The installation of shoreline buffers and streambank stabilization structures were identified as the third most highly ranked restoration technique in the Core Creek watershed - Lake Luxembourg Management Plan (Coastal, 1993). Therefore, the structural BMP component of the second Phase II Implementation Project focused on shoreline and streambank stabilization projects at five locations within Core Creek Park. Specifically, these projects included:

1. The upgrade of 300 ft of a swale that directly enters Lake Luxembourg to function more as a water quality BMP (Site 1),
2. The stabilization of approximately 200 linear ft of shoreline adjacent to a public fishing pier and approximately 100 ft of a near shore swale with the use of both standard and bioengineering techniques (Site 2),
3. The stabilization of approximately 800 linear ft of shoreline along the north central portion of Lake Luxembourg with the use of bioengineering techniques (Site 3),
4. The stabilization of approximately 200 linear ft of streambank of a tributary that directly discharges into Lake Luxembourg with the use of standard engineering techniques (Site 4), and
5. The stabilization of approximately 300 linear ft of streambank directly on Core Creek with the use of standard engineering techniques (Site 5).

A State General Permit for Bank Rehabilitation, Bank Protection and Gravel Bar Removal (BDWW-GP-3) was obtained for the five shoreline and streambank stabilization projects. In addition, Princeton Hydro worked under the guidance of the Bucks County Conservation District to ensure that each project was conducted in a manner as to minimize potential impacts on receiving waterways and/or loss of soil.

Once the permits were secured, Princeton Hydro worked closely with the Conservation District, the hired contractor, and the Bucks County Department of Parks and Recreation in the implementation of the five projects. The initial re-grading of the targeted sites was initiated in mid-March and completed by mid-April. Geo-textile filter fabric was applied and staked down at each site and clean stone was added where required (Site 2 swale, Site 4 and Site 5).

Between 17 and 23 of April, biologs were installed at Sites 1 and 3. In addition, 3/4" clean stone was used to create four 20 linear feet wide shoreline areas designated for fishing access along the length of Site 3. On 25 April 2001 the students from Neshaminy Middle School assisted the Bucks County Department of Parks and Recreation and Princeton Hydro in the installation of

shoreline vegetation at Site 3 (see Appendix E). Staff from the Department of Parks and Recreation and Princeton Hydro installed the shoreline vegetation at Site 1 and subsequently installed the silt and goose fencing at Sites 1 and 3.

The shoreline and streambank projects were all photo-documented through the duration of the second Phase II Implementation Project (Appendix F).

Task 4 - In-lake and Watershed-based Water Quality Monitoring Program

As part of this second Phase II Implementation Project, both the Core Creek watershed and Lake Luxembourg were monitored during the course of the project. The methodology associated with the monitoring plan were specifically detailed in the work/quality assurance project plan (Appendix B).

There were a number of reasons to include a water quality monitoring program in this second Phase II Implementation Project:

1. Quantification of current water quality conditions of both the watershed and the lake,
2. An extended evaluation of the effectiveness of the agricultural and shoreline/streambank BMPs, and
3. Obtaining additional data to develop a long-term data set of the watershed and lake to identify the presence of long-term trends in water quality.

Both the lake and the watershed were monitored through the course of the project. The methods, protocol and procedures were very similar to those used during the first Phase II Implementation Project. In-lake monitoring occurred three times (spring, mid-summer and late summer) in 1999 and 2000.

In-situ data (dissolved oxygen, temperature, pH) were collected at the deep sampling station and discrete water samples were collected for a variety of chemical and biological parameters. Both *in-situ* and discrete water quality sampling was also conducted at the inlet and outlet watershed stations of Core Creek.

As part of their in-kind services, the Department of Parks and Recreation supplied a boat,

motor, anchor and safety gear to conduct the in-lake sampling. All collected samples were transported to a State-certified laboratory for chemical analyses, while the phyto- and zooplankton samples were taken to Princeton Hydro's biological laboratory for identification down to the most practical taxon (i.e. genus or species).

A total of four stormwater sampling events were conducted within Core Creek Park. The results of both the in-lake and stormwater (watershed) monitoring programs, as well as an interpretation of these data relative to the long-term water quality database, are provided in detail in the Lake Luxembourg Water Quality Monitoring Report.